DOCUMENT RESUME

ED 170 574 CE 021 396

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TITLE	Marine Science Careers for the Junior High School Student. Student Workbook.
INSTITUTION	Rutgers, The State Univ., New Brunswick, N.J. Curriculum Lab.
SPONS AGENCY	New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.
REPORT NO	CE-370A
PUB DATE	Feb 79
NOTE	45p.; Photographs in this document will not reproduce well; For a related document see CE 021 395
AVAILABLE FROM	New Jersey Vocational-Technical Curriculum Laboratory, Building 4103 - Kilmer Campus, Rutgers University, New Brunswick, New Jersey 08903 (student manual and workbook, $4.75, plus postage)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Answer Keys; *Career Awareness; Charts; *Curriculum; *Individualized Instruction; Instructional Materials; Junior High Schools; *Learning Activities; *Marine Biology; Occupational Information; *Oceanology
IDENTIFIERS	New Jersey

ABSTRACT

Designed for junior high school students, this curriculum on marine science careers contains instructional materials on oceanography and related careers suitable for individualized study. The curriculum is organized into a study-direction book (see CE 020 395) and a separate answer-response book (included in this document). The answer-response book contains the answers to the learning activities and self-evaluation quizzes found in each of the eleven chapters of the study-direction book. In addition, the answer book contains optional exercises for the student. A progress chart is found at the end of the document for both the student's and teacher's benefit. (EM)

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ED170574

State of New Jersey
Department of Education
Division of Vocational Education

STUDENT WORKBOOK

MARINE SCIENCE CAREERS

for the Junior High School Student

Barbara G. Spencer, Science Teacher

Anthony J. Covino, Principal
Township of Ocean Junior High School

Photographs by Charles A. Burrus, Jr.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Rutgers – The State University
Building 4103 – Kilmer Campus
New Brunswick, New Jersey

Publication #0079
February 1979

CE 021 396

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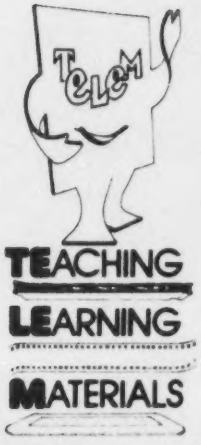

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Notes to the Teacher

This curriculum is an endeavor to collect and organize instructional materials in Oceanography and related careers suitable for individualized study. The curriculum is organized into a study-direction book plus a separate answer-response book. Short quizzes, "Are you on the right track?", are at the end of each unit for the student's self-evaluation. A progress chart is at the end of the answer book for both student's and teacher's benefit. Students should be encouraged to keep the chart up to date, indicating work completed; the teacher should record grades and comments on the chart frequently – to maintain close contact between student and yourself.

The student is urged to read the Preface, which is an attempt to develop a sense of concern about the ocean, to expand the classroom walls into the real world, which has real problems.

Although the program is written for an individualized approach, it can be adapted for a more teacher-directed situation. Indeed, the class should be brought together periodically at your direction to establish an awareness of itself. It is my belief that although many students appreciate the freedom of working at their own pace, they also respond positively to group interaction, discussion, exchange of ideas.

The teacher and student should participate in one-to-one conferences periodically. Few students are self-sustaining for a long period of time in an individualized study.

Field trips, guest speakers, and use of a variety of audiovisual media to increase student awareness of career opportunities are encouraged.

Hopefully, the laboratory and field experience will cause the student to become the investigator. The interdisciplinary nature of oceanography affords the opportunity for the student to acquire the basic principles of earth science and an exposure to a variety of career opportunities.

"Questions To Ponder" at the ends of the chapters are taken from: *Questions About the Ocean*, by Harold W. Dubach and Robert W. Taber. Published by the U.S. Naval Oceanographic Office, Washington, D.C. 20390, 1969.

Photo Credits: Charles A. Burrus, Jr. Ph.D., Fair Haven, New Jersey
Carolyn Nilsen for the salt marsh grass.

Chapter I: Global Landmarks

(A) X Marks the Spot

1–1.

1–2.

1–3.

1–4.

1–5.

1–6.

1–7.

1–8.

1–9.

(B) Sea and Land

1–10. Continents:

1–11. Oceans:

1–12.

1–13. Continents:

1–14. Oceans:

1–15.

1–16.

1–17. Continents:

1–18. Oceans:

1–19.

1–20.

1–21.

1–22.

1–23. Continents:

1–24. Oceans:

1–25. 1–26.

1–27. Continents:

1–28. Oceans:

1–29. Continents:

1–30. Oceans:

1–31.

(C) More About the Earth (Optional Exercise)

Scale: 1 cm equals 1000 miles

Radius equals _____cm.

Diameter equals _____ cm.

Diameter of earth equals _____ miles.

Circumference of the earth equals_____ miles.

Each degree of longitude at the equator equals _____ miles.

Each degree of latitude equals _____ miles.

40° north latitude equals _____ miles (approximately).

(D) Earth, the Water Planet

1–32. a. b. c. d.
e. f. g.

1–33. a. b. c. d.
e. f. g.

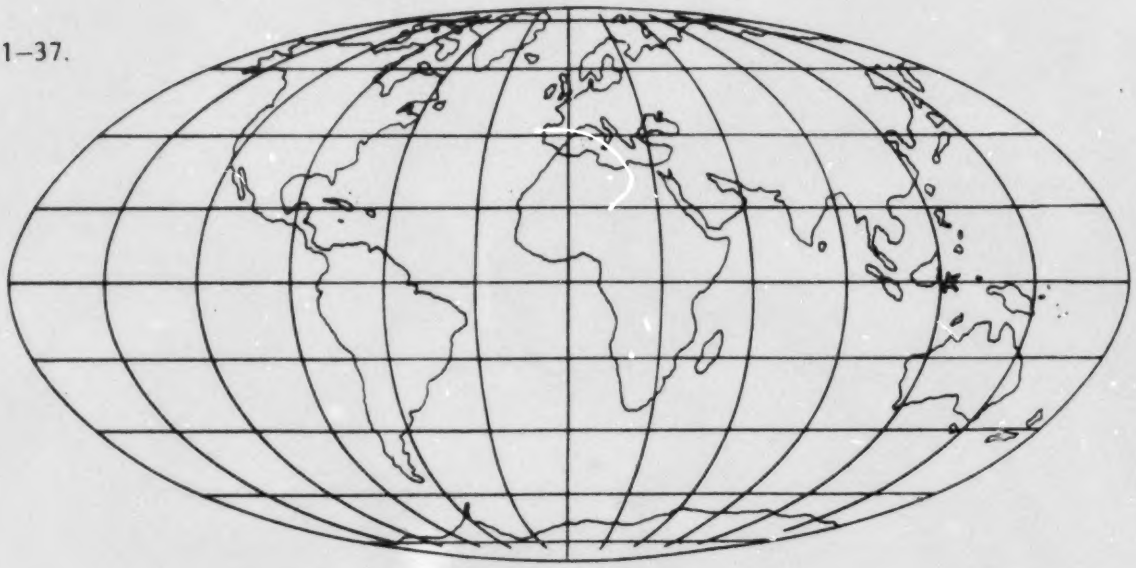
1–34.

1–35.

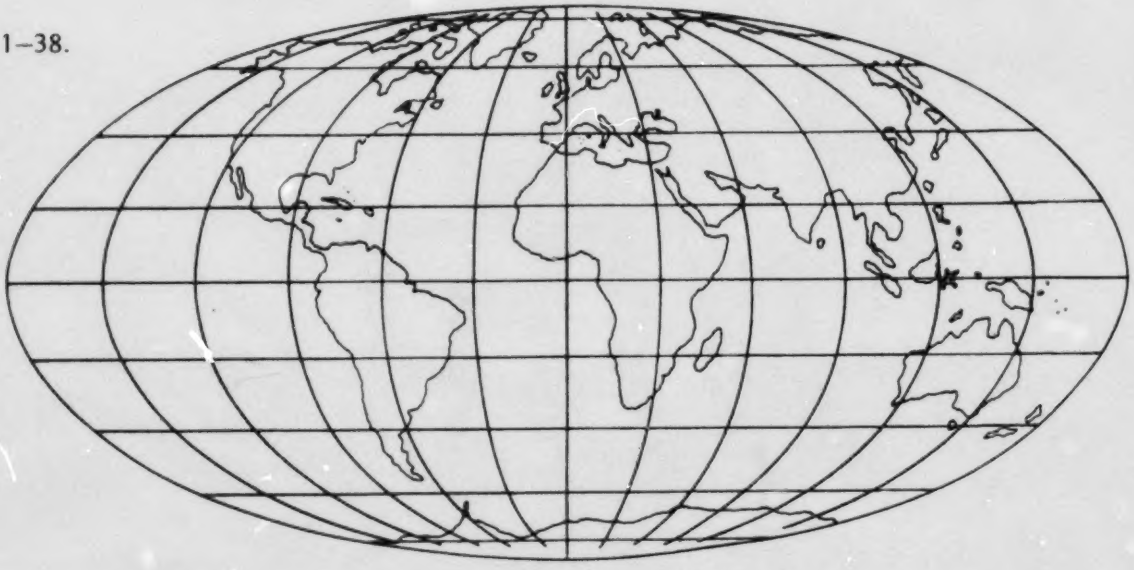
1–36. a. b.

(E) Are the Oceans Interrelated?

1–37.



1–38.



Self Evaluation:

1. a.

   b.

   c.

   d.

2.

3. True or False?

   Reasons:

4.

5.

6.

7.

Chapter II: The Navigator

(A) Training Chart

2–1. 2–4.

2–2. 2–5.

2–3. 2–6.

2–7.

2–8. a. b.

2–9. a. b.

2–10.

2–11.

NUN BUOY CAN BUOY

(B) The Magnetic Compass

True Bearing	Variation	Magnetic Bearing
150°	15°W	
	15°W	270°
90°		75°
	5°E	180°
220°	5°E	
65°		72°

Investigation: The Magnetic Compass

(Attach papers)

Sky Observation Data Sheet

Number	Object	Date	Time	Elevation in Degrees	Direction
1.					
2.					
3.					
4.					
5.					
6.	Moon				
7.	Moon				
8.	Moon				
9.	Planet				
10.	Planet				
11.	Planet				
12.	Polaris				
13.	Polaris				
14.	Polaris				

2–12.

2–13.

2–14.

2–15.

2–16.

2–17.

2–18.

2–19.

2–20.

2–21.

Self Evaluation:

1.

2.

3.

4.

5.

Chapter III: Charting The "Hidden Lands"

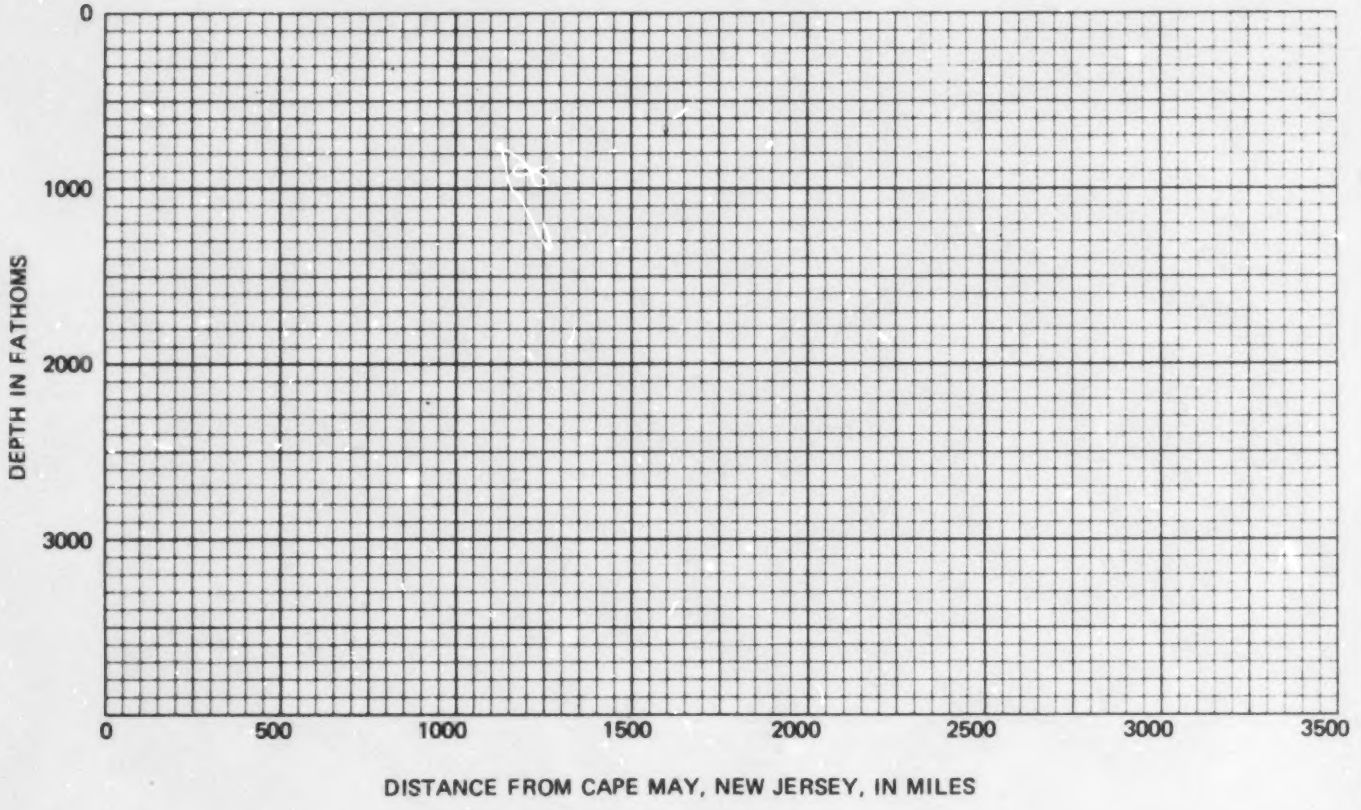
(A) Sounds in Water

3–1. The speed of sound in salt water is _____ ft./sec. (approximately).

3–2.

Sound Lapse Time	Depth in Feet
0.2 seconds	_____
1.5 seconds	_____
5.7 seconds	_____

3–3. Topographical Study – Contour of the Atlantic Ocean Floor at 39°N. Latitude



3–4.

1. continental shelf
2. continental slope
3. continental rise
4. submarine canyon
5. mid-ocean ridge
6. island arc
7. ocean trench
8. guyot

3–5.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

3–6. Cape May shelf is _____ miles wide.

3–7. Cape Roca shelf is _____ miles wide.

(D) How Are Minerals in Solution Deposited To Form Nodules?

3–8. **Observations:**

1.

2.

3.

4.

5.

3–9. **Conclusions:**

1.

2.

Self Evaluation:

1.

2. a.

   b.

   c.

3.

4. a.

   b.

   c.

   d.

Chapter IV: Charting the Water's Flow

(A) Making a Monthly Tide Graph

Use graph paper furnished by your instructor.

Observations:

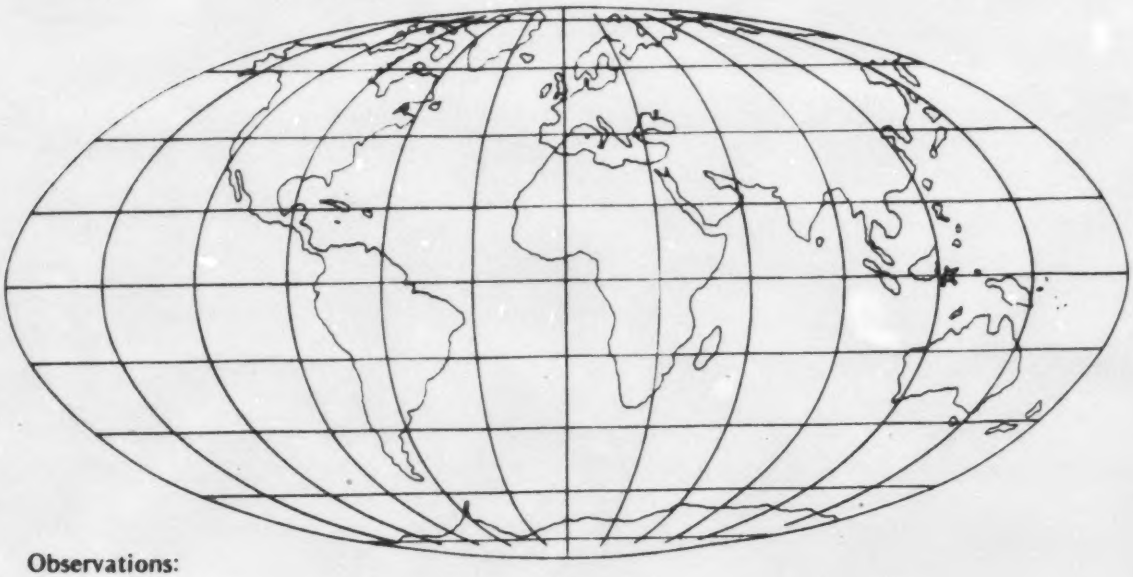
4–1.

4–2.

4–3.

4–4.

(B) Where Are the Major Ocean Currents?



Observations:

4–5.

4–6.

4–7.

4–8.

4–9.

4–10.

Self Evaluation:

1.

2.

3.

4. a.

   b.

   c.

5. a. b.

6. a. b.

7.

8.

A Career In Oceanography

Career:

Training Required:

Special Requirements:

Nature of the Work:

Is the Field Expanding?

Salary Range:

Additional List of Career Resources

Letter #1 – Rough Copy

Letter #1 – Final Form of Letter

Sailing Yacht

Fishing Boat

Related Jobs

Chapter VI: What Is the Ocean's Greatest Natural Resource?

Teacher Demonstration:

6–1. Observations:

Conclusions:

6–2. Water quiz:

1. _____	5. _____	9. _____
2. _____	6. _____	10. _____
3. _____	7. _____	11. _____
4. _____	8. _____	12. _____

6–3. Number of correct answers_____

6–4. The one most important use of water is:

6–5. Residues of three water samples:

6–6.

6–7.

(D) Current Flow and Salinity

6–8. 4% salt solution. Current flow =

6–9. 2% salt solution. Current flow =

6–10. Current flow of third solution =

6–11. Current flow of sea water =

6–12. Percent of last salt solution =

6–13. Estimate of salinity of sea water =

6–14. Hydrometer

Cold, fresh water: 1.00

35% solution: 1.025

6–15. Salinity Reading:

a. b. c.

Water of different temperatures:

6–16.

6–17.

6–18.

6–19.

Cold Water		Hot Water	
Initial	_____ °C	Initial	_____ °C
2nd reading	_____ °C	2nd reading	_____ °C

Observations:

a. Original color of layers _____

b. Condition of layers after five minutes _____

6–20.

Cold Water		Hot Water	
Initial	_____ °C	Initial	_____ °C
2nd reading	_____ °C	2nd reading	_____ °C

Observations:

a. Original color of layers _____

b. Condition of layers after five minutes _____

6–21.

6–22. Your observations:

6–23. Your observations:

6–24.

6–25. Evaporation of water:

Prediction:

6–26:

No.	Empty Wt.	Wt. #1.	Temp. #1.	Location	Time placed	Temp. #2.	Wt. #2.	Wt. Differ.	Time in Place
1									
2									
3									
4									
5									
6									

Questions:

6–27.

6–28. 0° _____ 60° _____

20° _____ 80° _____

40° _____

6–29.

6–30.

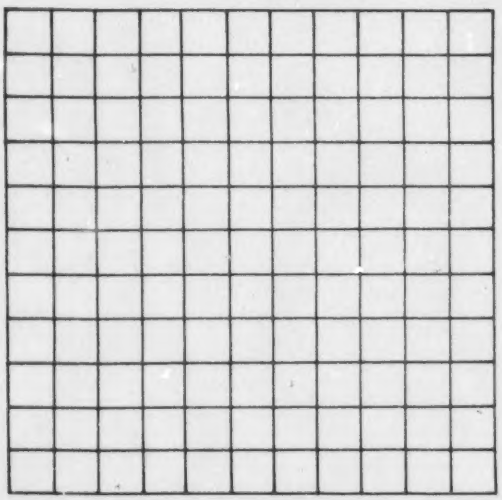
6–31.

a.

b.

c.

6–32.



6–33.

Self Evaluation:

1.

2.

3.

4.

5.

6.

Chapter VII: What Life Is There in the Ocean?

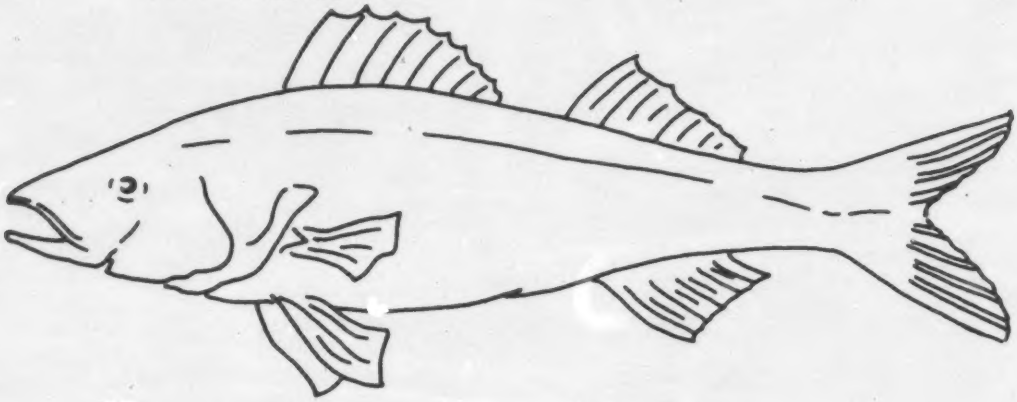
7–1. You be the judge . . .

The Fish

7–2.

7–3.

Label external features:



7–4. Functions of fins:

a. Dorsal fins:

b. Pectoral fins:

c. Pelvic fins:

d. Anal fin:

e. Caudal fin:

7–5. a.

b.

c.

7–6.

7–7.

7–8.

7–9. a.

b.

c.

General Anatomical Features of a Typical Pelagic Bony Fish

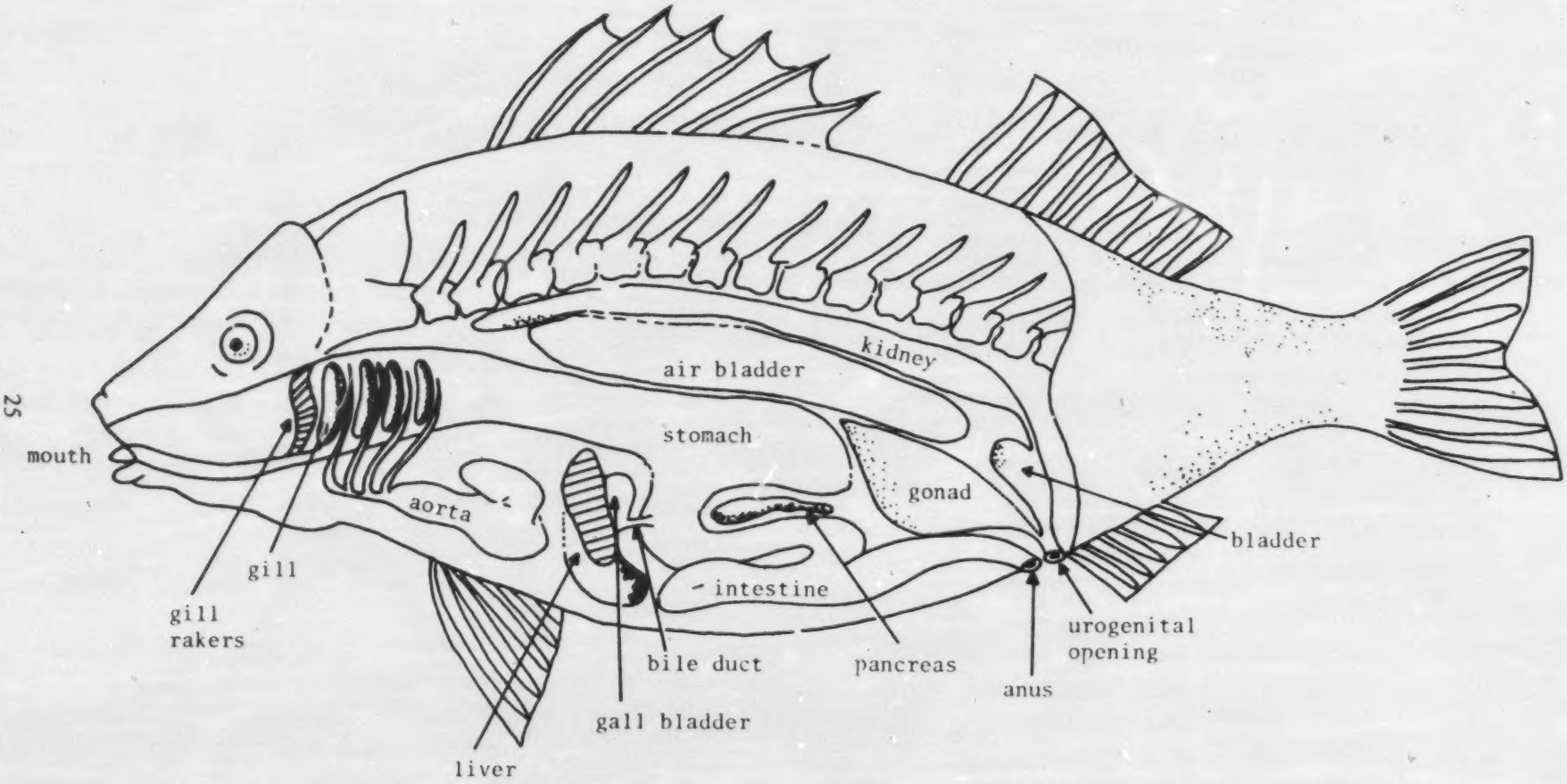


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Diagram from URI Marine Science Bulletin

30

Self Evaluation:

1.

2. a.

   b.

   c.

3. a.

   b.

4. a.

   b.

   c.

5. a.

   b.

   c.

6. Food web:

Current Study Sheet

Purpose:

To determine the velocity of the long shore current.

Equipment:

1 gallon plastic bucket with fairly long cord attached
sand
pieces of styrofoam "floats"
measuring tape
stop watch

Procedure:

Student #1, wearing waders, will toss bucket beyond breakers, emptying the pieces of styrofoam. Hold on to the cord! Retrieve bucket. The bucket should have a small amount of sand in it to give it weight. (You might want to try tossing the bucket a few times for practice).

Student #2, using a stop watch, will begin timing as soon as the floats hit the water.

Students #3, 4, and 5 stand on the shore a measured distance from each other and from the point where #1 student stood originally. Students will raise their arms as soon as the styrofoam floats are directly in front of them. (This is an eyeball task — tune your senses!)

Student #2 verbally states number of seconds it took for floats to pass in front of students stationed on the shore line.

Student #6 will record the time on the Current Study Sheets.

Together the team will determine the velocity of the long shore current.

$$\text{Velocity} = \frac{\text{distance traveled}}{\text{time to travel distance}}$$

Do all three stations agree? Repeat several times.
What contributed to the differences in velocity, if any?

Long Shore Current Data

	Distance	Time	Velocity
1			
2			
3			

Factors producing variations in results:

Data Sheet For Ocean

Salinity _____ °/oo

Density _____

Dissolved 0_2 _____ ppm

Temperature of water _____ °C.

Turbidity _____

Plankton concentration _____ /m^3

Data Sheet For Bay Side

Salinity _____ °/oo

Density _____

Dissolved 0_2 _____ ppm

Temperature of water _____ °C.

Turbidity _____

Plankton concentration _____ /m^3

Benthos Data Sheet

This data sheet will serve for either coring or digging for bay-bottom specimens.

Location _____ Time of Day _____

Method of Collection: _____

Type of Substrate	Types of Organisms	Count	Depth
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

Seine Data Sheet

Sample Number_____ Station Number_____ Date _____

Time_____ Height of Waves_____ Cloud Cover_____

Temperature: Water_____ Air_____

Depth_____ Tidal Reading_____ Salinity _____

D.O. _____ Current Rate_____ Bottom Type _____

Area Covered by Seine_____

Living Organisms

Plants	Animals
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Self Evaluation:

1. a.
   b.
   c.

2.

3. a.
   b.

4.

5.

Chapter IX: Investigation of Field-Trip Specimens

9–1. Plankton sketches:

9–2. Plankton sketches:

9–3. Ratio between plants and animals: _____

9–4. Three consequences of low plankton growth due to pollution:

a.

b.

c.

9–5. General characteristics and classification of common blue mussel:

9–6.

9–7. Mussell Data Sheet

Size Ranges of Mussels

Habitats	___cm to ___cm	___cm to ___cm	___cm to ___cm	___cm to ___cm	___cm to ___cm
#1 _____ _____					
#2 _____ _____					

9–8.

9–9.

The Fish

9–10 a.

b.

9–11.

9–12.

9–13.

9–14. a.

b.

9–15.

9–16. Sketch

9–17. a.

b.

9–18.

9–19. Measurement of Oxygen Consumption of Fish

Weight
Beats per min.

No.	Temp.	1	2	3	4	5	6	7	8	9	10
1.	10°C										
2.	20°C										
3.	30°C										
4.	40°C										
5.	50°C										
6.	60°C										

9–20.

	A Total No. of Beats	B Total Weight	C $\frac{\text{Total Beats}}{\text{Total Weight}}$	D Beats/Min per gram
10°C				
20°C				
30°C				
40°C				
50°C				
60°C				

9–21. a.

b.

9–22.

9–23.

9–24.

9–25.

9–26.

9–27.

9–28.

9–29.

Self Evaluation

1. a.
   b.
   c.
2. a.
   b.
3.

4.

5.

6.

7. Graph -- Physical Properties of Water, Ocean and Bay Sides

8. a.

b.

c.

10–1.

1.
2.
3.
4.
5.
6.
7.
8.

10–2.

Self Evaluation

1.

2. Were you . . .
   a. Helpful?
   b. Courteous?
   c. Brief and to the point?
   d. A good listener?
   e. Friendly?
   f. Patient?
   g. Sincere?

3. Did you compromise wisely?

4. Were you satisfied with the decision of the group?
   Why or why not?

5. Were you well prepared to contribute good information to your group discussion?

Progress Chart

As you finish each activity in the chapter, record the name of the activity and the date finished.

Chapter No.	Name of Activity	Date finished	Grade	Teacher's Comments